The first chapter may be regarded as a summary of those parts of mathematics and mathematical physics which are applied to wireless telegraph problems in the author's larger treatise. There is a brief exposition of differential and integral calculus, of differential equations, of the theory of the Argand diagram, and of vector analysis, culminating in an explanation of the more mathematical aspects of divergence, curl, and vector potential, and in the derivation of Poisson's equation and Stokes's theorem. Later this theory is applied in the orthodox way to the formation of Maxwell's equations and to the solution in the standard manner of the Hertz oscillator problem. The second chapter is more physical than the first, and deals with the important subjects of units and dimensions.

Chapters iii. to vi. discuss the laboratory physics of wireless telegraphy, attention being paid especially to the derivation of the formulæ used in the electrical laboratory. For example, there is a good and fairly full account of the theory of certain bridge methods of measuring inductance and capacity. Chapters ix. and x. deal with the principles underlying the production of electric waves, and contain the principal formulæ for the radiation from antennæ. Similarly the next chapter, on the reception of signals, is devoted largely to principles, though containing some useful pages occupied with brief descriptions of various detectors. From the list of detectors the modern forms of the vacuum valve detector and relay are all missing, although these are playing so large a *rôle* in recent long-distance triumphs in wireless telegraphy and telephony. Chapter xi. begins the practical portion of the work. In it are given the Morse code, some hints on the management of storage cells, a couple of pages on the management of wireless telegraph apparatus, and a glossary of terms. Chapter xii. concludes the book with about fifty pages of the usual mathematical tables and eight pages of tables of physical constants. The mathematical tables are very beautifully printed, and contain some improvements designed to make reference rapid and easy.

The most permanent impression left by the book on the mind of the reviewer is that the author appears to entertain a very high opinion of the intellectual equipment of the wireless telegraphist and of his ambition to breathe the rarest atmosphere of the subject. In all probability the book will receive a warmer welcome from the advanced students of electro-technics in our colleges than from the class it is ostensibly written for.

(2) This little book is a translation of one issued two or three years ago by the Paris Bureau of Longitudes for enabling French nagivators, clockmakers, and others requiring accurate time, to make full use of the excellent series of radiotelegraphic time signals sent daily from the Eiffel Tower station. Since the Paris station is only one of a projected international chain of time stations, such a book as this is, or will be, useful in other countries.

The work begins with a clear description of the apparatus needed by a person who wishes to receive the time signals; several types of apparatus are, in fact, described, beginning with the very simplest and closing with a fairly elaborate plant. It will be difficult to find anywhere an explanation more helpful to the novice than this. Then follows an account of the kinds of time signals emitted from the Eiffel Tower, which include morning and evening sets of signals intended for navigators and horologists, and also scientific signals which give, by an application of the method of coincidences, the time accurate to about 1/100 second.

Of course, the war has put much of the work of the Eiffel station out of joint; for instance, the meteorological signals described in this book are not now transmitted as before, but no hint of this fact is given in the book, which, though dated 1915, speaks as if everything were proceeding normally everywhere. This failure to take account of the effects of the war on wireless telegraph matters appears even in the translators' appendices, in one of which it is stated that English weather reports are issued daily by the Admiralty from Whitehall and Cleethorpes. The writer of this review cannot affirm with finality that such reports are not issued; no private individual is now allowed to possess "wireless" apparatus to test the matter—but it is unlikely that meteorological reports are sent broadcast at this period. This fault is apparently the only fault of the work, and it is here pointed out for the sake of historical accuracy.

THE STEAM ENGINE.

Steam Power. By Prof. W. E. Dalby. Pp. xvi +760. (London: Edward Arnold, 1915.) 21*s*. net.

IN this volume we have the most complete, the most scientifically correct, and the most up-to-date treatment of the problem of the generation of steam and its utilisation for power purposes which has ever been put at the disposal of the engineer and the designer of power plants.

Although Sir J. A. Ewing in the latest edition of his book on the steam engine had accepted the characteristic equation of Callendar and had utilised the steam tables derived from it by Mollier, and had thus directed the attention of the British engineering world to Callendar's researches, it is to be feared that the majority of our engineers were still ignorant of and oblivious to the epoch-making character of Prof. Callendar's researches and his work in the field of thermodynamics.

Prof. Dalby has made it impossible for anyone in the future to ignore these researches. In chapter iii., on the motive-power circuit-thermodynamics, in sections 47 to 49 Callendar's characteristic equation of steam is dealt with in a clear and concise fashion; and the whole of the steam tables in the appendix have been calculated by Prof. Callendar himself from the expressions given in this chapter. In chapter iv. the sections dealing with the so-called "missing quantity" are practically based upon the researches of Callendar and Nicolson (by a slip in the preface an account of these researches is stated to be incorporated in chapter v.), and lastly Prof. Callendar's work on the theory of the flow of steam through nozzles is made free use of in chapter xi., which deals with this important branch of the subject, of such vital importance in the design of steam turbines. We have indicated enough to show how largely the author has drawn upon the rich stores of theory and experimental results which Prof. Callendar has placed in recent years at the disposal of engineers.

Following Sir J. A. Ewing, the author has abandoned the Fahrenheit and adopted the Centigrade scale; modern research is always expressed in terms of this latter scale, and it is certainly high time that British and American engineers discarded for ever the Fahrenheit scale, which introduces needless complications, and has nothing to commend it; for commercial reasons alone it would be a great advantage to engine-builders and others to come into line with the rest of the world and to adopt the Centigrade scale. It may be a difficult matter to introduce in its entirety the metric system, though we have little doubt that sooner or later such a change must be made, but it would surely be an easy matter to pass an Act enforcing the use, after a given interval of time, of the Centigrade thermometer and making it illegal to manufacture any longer Fahrenheit thermometers. The Meteorological Department has recently made a valuable step forward in deciding that in future rainfall records shall be given in millimetres. Why not go a step further and publish all their temperature records in the Centigrade scale? Were the Department to take this step the public would soon fall into line, and in a short time everyone would as readily think in Centigrade units as they do now in Fahrenheit units. We warmly congratulate the author for the decision he came to in this matter; for the time being it is necessary, if we use the Centigrade scale, to adopt a somewhat unusual heat unit—the lb.-calorie, but such a unit is inevitable so long as we retain the pound as the unit of weight.

Prof. Dalby has for some time been in the front rank of those workers who have specialised in that section of thermodynamics which deals with the problem of the steam locomotive, and he has drawn freely upon his published researches for much of the matter contained in chapter viii., which deals with the motion of a train and the rate at which energy must be spent to produce, to maintain, and to destroy it. This chapter will prove invaluable to the designers of locomotives; it is largely the result of original work, and the problems to be solved have been attacked in a strikingly novel manner. The validity of the author's methods has been confirmed by examination of the published results of elaborate tests of the performances of locomotives carried out in the United States. It is well known that Prof. Dalby has organised a highly successful post-graduate course in railway engineering at the Imperial College of Science, South Kensington, and this chapter is a striking testimony to the thoroughness with which he is attacking the problems which will have to be faced if any radical improvement in the thermal efficiency of the steam locomotive is to be obtained in the near future.

Two other chapters which will be specially useful to the drawing office are those dealing with the balancing of engines, and valves and valve-gear diagrams, treated, of course, in a more condensed fashion than in the author's well-known text-books on these two branches of engine design, but still in a sufficiently full and complete form for the engineer who aims at acquiring a sound knowledge of the principles upon which the successful design of engines must be based.

The last chapter deals with steam turbines, and we think Prof. Dalby has in this chapter produced the best account we have ever read of this class of steam generators, both from the point of theory and of actual design, and it says much for his methods that he has been able to do this in some seventy-five pages.

If we have any criticism to offer on this book, it is in the form of a suggestion that in any reissue the book should be broken up into two volumes. The present volume contains 760 pp., and is really too cumbersome and heavy for convenient use. If chapters i. to vi. and chapter xi. formed one volume, with the steam tables as an appendix, the other chapters would fit well into a second volume.

In conclusion, we offer our warm congratulations to the author. He has achieved a great task; this book is a testimony to his powers as an original worker, and to the wide grasp he has obtained of the whole field of work covered by it. We would commend a careful study of the book to those, only too numerous, detractors of the work achieved by British men of science and practical engineers. They will find ample testimony that in this field of human activity the British workers easily hold a foremost place.

T. H. B.

MATHEMATICAL TEXT-BOOKS.

(1) *Plane Geometry.* By G. St. L. Carson and Prof. D. E. Smith. Part i., pp. vi+266. Part ii., pp. vi+259–482. (London and Boston: Ginn and Co., 1914–15.) Price 2*s*. 6*d*. each part.

(2) *Elements of Algebra.* By G. St. L. Carson and Prof. D. E. Smith. Part ii., pp. v+538. (London and Boston: Ginn and Co., 1915.) Price 2*s*. 6*d*.

(3) *Contributions to the Founding of the Theory of Transfinite Numbers.* By G. Cantor. Translated by P. E. B. Jourdain. Pp. ix+211. (Chicago and London: The Open Court Publishing Co., 1915.) Price 3*s*. 6*d*. net.

(4) *A Text-book on Practical Mathematics for Advanced Technical Students.* By H. L. Mann, Pp. xii+487. (London: Longmans, Green and Co., 1915.) Price 7*s*. 6*d*. net.

(5) *Descriptive Geometry.* By H. W. Miller. 3rd edition. Pp. 149. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1915.) Price 6*s*. 6*d*. net.

(1) MANY attempts are now being made to formulate a system of geometry suitable to the immature minds of schoolboys, which will on one hand develop their reasoning faculties by some kind of logical training, and on the other by a sufficiency of practical work clarify their ideas as to the concepts which form the basis of the subject.

It is unfortunately true that as yet no general agreement has been obtained, or any course determined which is not open to formidable attacks from one school of thought or another. Time alone will bring about consensus of opinion in a controversy that has raged since the time when Lewis Carroll wrote his "Euclid and his Modern Rivals"; and educational opinion will gradually solidify by the action of those teachers and writers who are attempting to express the results of their personal experience.

If for no other reason, we hope that this volume will receive the serious consideration it merits; for it offers, not indeed a final, but certainly a valuable contribution to these issues. It would be beyond the scope of this notice to examine in any detail the course followed; and it is detailed examination alone that justifies the passing of any judgment. The authors have had extensive experience in the matters of which they write, and the views they have formed are the product of a genuine knowledge of the needs and capacities of junior students and of those psychological considerations to which educationists are now attaching due importance.

(2) The first part of this text-book has already been noticed in these columns; the second part, written on similar lines, carries the student as far as progressions and the binomial theorem for a positive integral index. We notice with regret that the section on graphs includes the tracing of the ellipse $4x^2+9y^2=288$; such work should, in our opinion, be relegated to co-ordinate geometry proper; we think also that examples on the greatest term in a binomial expansion, although sanctioned by tradition, might well be omitted from the ordinary algebra course. But, except for a few minor points such as these, the character of the book appears to us excellent, and we shall expect to see it hold its own in the strenuous competition that every text-book on elementary algebra has now to face.

(3) This volume contains the two classical memoirs on transfinite cardinal and ordinal numbers which Prof. Cantor contributed to the *Mathematische Annalen* in 1895 and 1897. They are prefaced by a long introduction (more than 80 pages) by Mr. Jourdain, in which he traces the growth of the theory of functions through the nineteenth century, with special reference to the work of Cantor and Weierstrass; the concluding pages of the book contain some notes on modern developments.

This introduction will undoubtedly prove of great value to English students and teachers; its admirable summary of the progress of ideas will smooth their pathway and assist and encourage them to study that modern work to which the author has himself already furnished substantial contributions.

(4) Although the first few chapters are devoted to such algebra, trigonometry and geometry as technical students are likely to require, the main purpose of this book is to provide a suitable